Binomial Distr.

4 conditions:

- set # of trials
- are independent
- 2 outcomes:
  success/failure
- prob of success remains constant thru all trials

Ex: pop quiz

$n = 10$

knowing ans to #1 doesn't help on #2

RIGHT
WRONG

$p = 0.25$

Notation

$B(n, p)$ ← prob. of "success"

$N(10, 2)$

$\mu_x = E(x) = n \cdot p$

$\sigma_x = \sqrt{n \cdot p \cdot (1-p)}$

$P(x=6)$

$P(x=7)$

... discrete random variables

- Formula: $P(X=k) = \binom{n}{k}(p^k)((1-p)^{n-k})$

$P(D)=0.25$

$n=4$

B(4, 0.25)

X	P(X)	
0	$(4nCr0)(0.25^0)(0.75^4)$	$= 0.3164$
1	$(4nCr1)(0.25^1)(0.75^3)$	$= 0.4219$
2	⋮	$= 0.2109$
3	⋮	$= 0.0469$
4	⋮	$= 0.0039$

$B(10, 0.25)$

x	$P(x)$
0	0.0563
1	0.1877
2	0.2816
3	0.2503
4	0.1460
5	0.0584
6	0.0162
7	0.0031
8	0.00039
9	0.000029
10	0.0000009 54

$P(X = 9) = 0.000029$

$P(X < 4) = 0.7759$

$P(X \geq 6) = 0.01972$

$P(5 \leq X \leq 7) = 0.0777$

$n = 10$

$n = 50$

$n = 100$

$P(X=6) = (10\,nCr\,6)(0.25^6)(0.75^4) = 0.0162$

$P(X \geq 5)$

same as formula

For $P(X=k)$

- Use binompdf(n, p, k)
- k = # of "successes"
- Pdf = prob. density fctn.

x	P(x)

For $P(X \leq k)$

- use binomcdf(n, p, k)
- k = # of successes
- cdf = cumulative density fctn.

$P(X \leq 4)$

↑ add up as you go along

* PROBABILITY NOTATION

$P(X \geq \underline{\#}) =$ answer

$B(8, 0.3)$ cdf $\leq$

① $P(X=4) = \text{binompdf}(8, 0.3, 4) = 0.1361$

② $P(X \leq 2) = \text{binomcdf}(8, 0.3, 2) = 0.5518$

③ $P(X \geq 3) = 1 - P(X \leq 2) = 1 - \text{binomcdf}(8, 0.3, 2)$

$= 0.4482$

④ $P(X < 5) = P(X \leq 4) = \text{binomcdf}(8, 0.3, 4) = 0.9420$

⑤ $P(X > 6) = 1 - P(X \leq 6) = 0.0013$

Example: $B(150, 0.45)$

① $\mu_X = n \cdot p = (150)(0.45) = 67.5$

② $\sigma_X = \sqrt{n \cdot p \cdot (1-p)} = \sqrt{(150)(0.45)(0.55)} = 6.093$

③ $P(X = 75) = 0.0306$

④ $P(X \leq 60) = 0.1251$

⑤ $P(X \geq 60) = 0.9058$

⑥ $P(X < 60) = 0.0942$

⑦ $P(X > 60) = 0.8749$

⑧ $E(X) = 90 = n(0.45)$

$\mu_X =$

$1 - P(X \leq 59)$

$P(X \leq 59)$

$1 - P(X \leq 60)$

$n = 200$

wksht 5.1

8 + 9

8. $\mu = 200 \cdot 0.83 = 166$

$\sigma_x = \sqrt{166(1-0.83)} = 5.3122$

$\mu \pm \sigma$

9. $P(160.6878 < x < 171.3122) = 0.6998$

$P(161 \leq x \leq 171)$

binomcdf(200, 0.83, 171)
− binomcdf(" , " , 160)